Special Lab Is Battery Proving Ground

At Argonne's Electrochemical Analysis and Diagnostic Laboratory (EADL), battery developers can conduct unbiased tests and detailed post-operation analysis of cells and battery systems. Developers use the data from the EADL to assess the performance, technical progress, and quality control of their battery products. Armed with such data, they can better focus their development efforts. The EADL was established by the U.S. Department of Energy in 1976. It provides unique facilities for conducting performance and lifetime tests and for post-test examination of cells and batteries. The laboratory has been cited for excellence by the Department of Energy, the U.S. Advanced Battery Consortium, and the private sector.

Ultracapacitors

Ultracapacitors may have what it takes to make electric and hybrid vehicles a commercial reality with wide acceptance. Because double-layer or galvanic ultracapacitors have high-surface-area electrodes, they can provide high power very quickly. Thus, when used with batteries, ultracapacitors can provide the power required for rapid vehicle acceleration. In a new initiative, Argonne is combining its materials and battery-related expertise to research and improve existing

ARGONNE NATIONAL LABORATORY

Argonne National Laboratory is committed to developing high-quality, cost-effective products that meet the nation's goals of improving energy efficiency, reducing emissions, and manufacturing affordable, advanced-technology vehicles.

The Laboratory has forged partnerships with many firms in the energy and transportation sectors over the past two decades. Our location, right in the nation's heartland and industrial center, makes cooperative research easily accessible and cost-effective.

Argonne's wide-ranging battery and ultracapacitor research and development programs are providing solutions to the challenges of creating the new generation of electric and hybrid vehicles. These programs are supported by the Department of Energy, the U.S. Advanced Battery Consortium, and U.S. industry.

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ENERGY STORAGE

Ultracapacitors and Batteries

Materials Development

Electrochemical Characterization

Structure Analysis

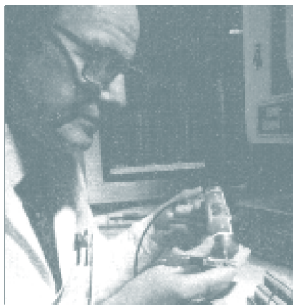
Modeling and Design

Battery Testing and Evaluation

Safety and Environmental Issues

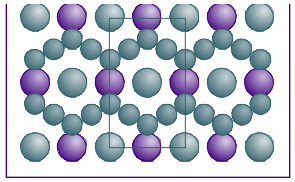
ARGONNE NATIONAL LABORATORY

Lithium Batteries Show Promise for Electric Vehicles



Rechargeable lithium batteries are becoming increasingly popular for powering such electronic equipment as cellular phones and laptop computers; they are also of interest in the longer term for electric vehicle (EV) applications. Their light weight and high energy density could help increase vehicle range, and their components are relatively inexpensive. Argonne is developing lithium-polymer batteries for EV applications under a cooperative research and development agreement with the U.S. Advanced Battery Consortium, 3M,* and Hydro-Quebec. These batteries make use of a metallic lithium negative electrode, a polyethylene oxide-based solid electrolyte, and a metal oxide positive electrode. The battery program at Argonne is also developing lithium-ion batteries with U.S. industry. Unlike lithium-polymer batteries, lithium-ion batteries use liquid electrolytes and insertion compounds at both positive and negative electrodes. During charge and discharge, lithium ions are shuttled to and fro between the host structures of the two electrodes.

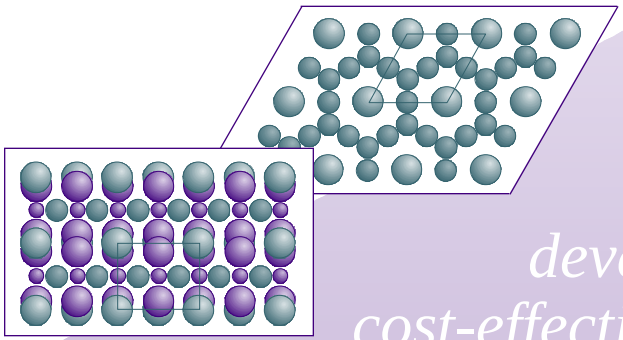
3M Corporation: "Argonne has made significant contributions to lithium-polymer battery technology development… As we push forward towards commercialization, we continue to look to ANL for advanced cathode



Nickel-Metal Hydride Batteries

Studies at Argonne could lead to cheaper, higher capacity nickel-metal hydride batteries. These batteries are very important to the automotive, electronics, and portable power tool industries because they have long cycle life and are more environmentally acceptable than nickel-cadmium batteries. Their relatively high energy and power density have led the U.S. Advanced Battery Consortium to select this technology as a midterm battery candidate for electric vehicles.

Adding certain elements to the nickel-metal alloy greatly increases the battery capacity—and thus the vehicle's potential range. However, these additives make nickel-metal hydride batteries prohibitively expensive. Argonne is investigating the relationship among the added elements, alloy structure, and electrochemical performance. With this knowledge, it may be possible to find less expensive additives that would provide the same—or even greater—battery capacity and performance. The researchers charge and discharge metal hydride cells while the cells are exposed to the neutron beam from Argonne's Intense Pulsed Neutron Source for structure analysis. Argonne is unique in possessing both battery testing and neutron diffraction capabilities on-site. This work is supported by the Army Research Office, through the Illinois Institute of Technology.



High-Temperature Battery Systems

While low-temperature batteries are currently the focus of much research, high-temperature batteries offer higher performance, and some offer sufficient reliability and safety. Argonne scientists and engineers have been instrumental in developing and refining two high-temperature battery systems, namely, the lithium-iron disulfide and sodium-metal chloride systems. In work on lithium-iron disulfide systems, Argonne developed a very stable ceramic-to-metal sealant that made possible a more compact and efficient configuration. Other discoveries were an electrochemical means of overcharge protection and electrode additives that improved battery energy and power. In work on sodium-metal chloride cells, researchers improved cell performance by changing the shape and chemical composition of the positive electrode. Thus, Argonne is well-equipped for the special demands of high-temperature battery research.

Committed to developing high-quality, cost-effective energy storage devices that meet the nation's goals of improving energy efficiency